# Capacity Building in the Use of Geospatial Tools for Natural Resource Management in Tajikistan

**Inception Report for the Swiss Consultant Trust Fund (CTF) Support**

Centre for Development and Environment (CDE)

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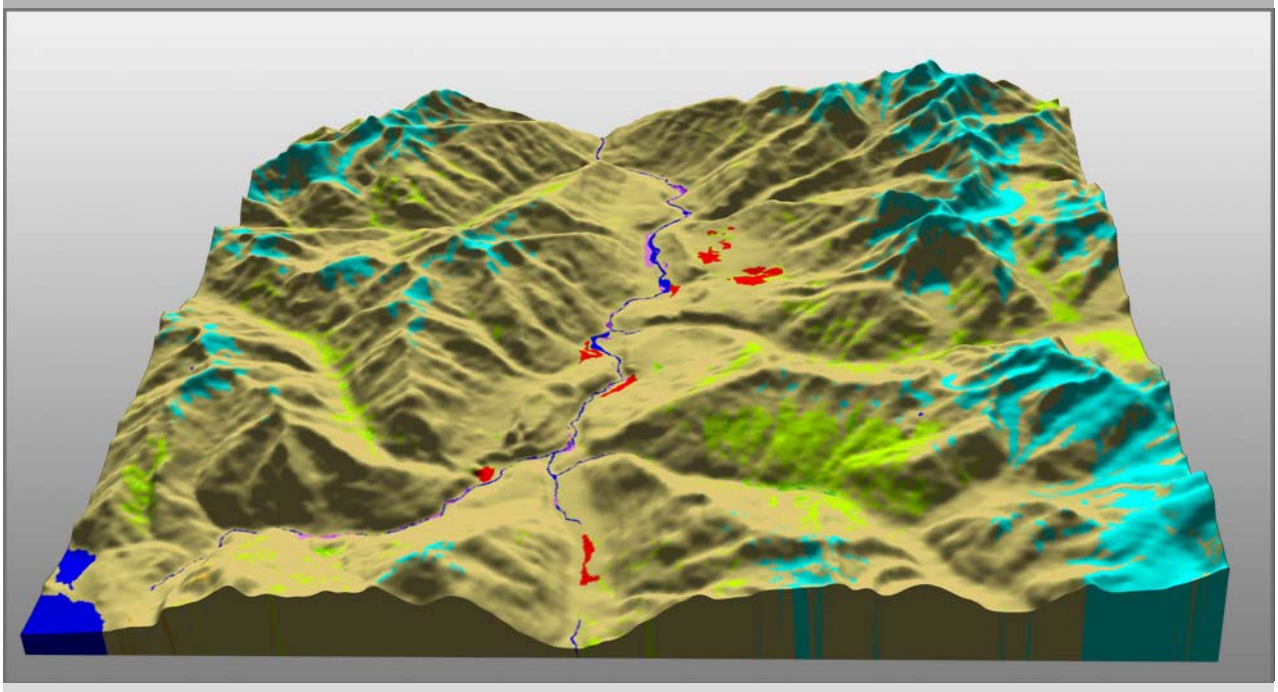

## Impressum

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# List of abbreviations and Tajik terms

| | |
|---|---|
| ACTED | Agency for Technical Cooperation and Development |
| AKF | Aga Khan Foundation |
| BNWPP | The Bank-Netherlands Water Partnership Program |
| CAWMP | Community Agriculture & Watershed Management Project |
| CDE | Centre for Development and Environment, University of Bern, Switzerland |
| CTF | Consultant Trust Fund |
| FAO | Food & Agriculture Organization |
| FO | Facilitating Organization |
| GAA | German Agro-Action (now Welt Hunger Hilfe) |
| GIS | Geographic Information System |
| GIPROZEM | The State Project Institute for Land Management "Tojikzaminsoz" |
| GLASOD | Global Assessment of Human Induced Soil Degradation |
| GOSKOMSTAT | State Committee of Statistics, Republic of Tajikistan |
| GoT | Government of Tajikistan |
| GPS | Global Positioning System |
| ha | Hectares |
| IAEA | International Atomic Energy Agency |
| ILWIS | Integrated Land and Water Information System |
| IMAC | Information Management and Analytical Centre, Ministry of Emergency Situations and Civil Defence of Tajikistan |
| IT | Information Technology |
| Jamoat | Smallest political entity |
| MSDSP | Mountain Societies Development and Support Program |
| NASA | National Aeronautics and Space Administration |
| NGO | Non-Governmental Organisation |
| NRM | Natural Resources Management |
| PCU | Project Coordination Unit |
| PMU | Project Management Unit |
| SLM | Sustainable Land Management |
| SRC | Strategic Research Centre |
| SRTM | Shuttle Radar Topography Mission |
| SSRI | Soil Science Research Institute |
| TAAS | Tajik Academy of Agricultural Sciences |
| TajikNIIGiM | Tajik Research Institute of hydraulic engineering and land reclamation |
| Tojikkoinot | Agency for Land Management, Geodesy and Cartography |
| Tojikzaminsoz | The State Project Institute for Land Management (formerly known as GIPROZEM) |
| UNDP | United Nations Development Programme |
| USLE | Universal Soil Loss Equation |
| USGS | United States Geological Survey |
| WB | World Bank |
| WHH | Welt Hunger Hilfe (formerly known as German Agro-Action, GAA) |

# 1 Project overview

## 1.1 Background

### 1.1.1 Sustainable management of natural resources

The sustainable management of natural resources is a key issue for sustainable development of a poor, mountainous country such as Tajikistan. In order to strengthen its agricultural and infrastructural development efforts and alleviate poverty in rural areas, spatial information and analysis are of crucial importance to improve priority setting and decision making efficiency. However, poor access to geospatial data and tools, and limited capacity in their use has greatly constrained the ability of governmental institutions to effectively assess, plan, and monitor natural resources management.

The Centre for Development and Environment (CDE) has thus been mandated by the World Bank Group to provide adequate technical support to the Community Agriculture and Watershed Management Project (CAWMP – see section 1.2.1 below). This support consists of a spatial database on soil degradation trends in 4 watersheds, capacity development in and awareness creation about geographic information technology and a spatial data exchange hub for natural resources management in Tajikistan. CDE's support has started in July 2007 and will last until December 2007 with a possible extension in 2008.

### 1.1.2 The Community Agriculture and Watershed Management Project (CAWMP)

The Bank-financed Community Agriculture and Watershed Management Project (CAWMP) in Tajikistan aims at building productive assets of rural communities in four selected mountain watersheds (see *Chapter 1.1.3* below) in order to increase agricultural productivity and household incomes, and to curtail degradation of fragile lands and ecosystems. Capital investment in rural manufacture will promote three types of activities: (1) Farm productivity improvement, (2) sustainable land management, and (3) rehabilitation of rural infrastructure.

The need to build capacity in the use of geospatial tools for natural resource management in Tajikistan has become particularly evident in the CAWMP. As part of its results framework, the CAWMP design envisaged a geospatial analysis of historic land degradation trends in the four project areas. However, due to lack of in-country capacity, this analysis has not yet been carried out. By using the CAWMP as a "learning lab" for the initial phase of this capacity building effort, one can ensure that:

(a) the concrete outputs answer an existing demand and will therefore be well-utilized,
(b) capacity building will be practical and realistic.

Also it should help to develop skills and replicable approaches that can subsequently be applied to other natural resource management issues.

### 1.1.3 The project areas

The project is carried out in the four watersheds of the Zerafshan, Surkhob, Vanj and Toirsu rivers (see *Figure 1*), covering catchments of over 36,000 km$^2$, with agricultural areas covering about 6,900 km$^2$, and with a population of approximately 550,000 people (42% of Tajikistan's mountain population). Land use in the four watersheds is characterised by mainly irrigation agriculture and livestock husbandry, with a large proportion of subsistence farming. See *Table 1* for population, number of households, administrative units and types of farms for each watershed.

*Table 1: Characteristics of the four watersheds*

| Watershed | District (Rayons) | No of Jamoats | No of villages | Rural population | No of rural households | No of dekhan and cooperative farms | No of kolkhozes and sovkhozes |
|---|---|---|---|---|---|---|---|
| Surkhob Valley | Darband (30%) | 2 | 26 | 16,000 | 2,133 | 11 | 5 |
| | Jirgital | 9 | 49 | 51,600 | 10,072 | 143 | 12 |
| | Rasht | 12 | 117 | 80,600 | 12,515 | 263 | 4 |
| | Tajikibad | 4 | 43 | 32,000 | 5,107 | 197 | 11 |
| Vanj Valley* | Vanj | 6 | 57 | 28,300 | 28.55 | 19 | 2 |
| Zerafshan Valley | Aini | 8 | 62 | 77,400 | 15,411 | 31 | 3 |
| | Matcha | 2 | 30 | 12,000 | 2,628 | 14 | 12 |
| | Pendjikent | 14 | 134 | 170,300 | 34,048 | 59 | 13 |
| Toirsu Valley | Danghara | 8 | 75 | 81,700 | 11,059 | 120 | 10 |
| Total | 9 | 64 | 593 | 549,900 | 93,002 | 857 | 72 |

*Number of households for Vanj Valley have been estimated using regional family size averages

Source: CAWMP

The project areas face a number of bio-physical constraints (high-mountain conditions, climatic variations, etc.), which make land resources naturally prone to degradation. Only sound management systems can avert the various forms of environmental degradation including water and wind erosion. However, difficult livelihood conditions (low agricultural production, limited access to land and irrigation, irregular water and power supply, and prohibitive prices for alternative energy sources) and insufficient land management create high dependence and pressure on local natural resources eventually resulting in overuse and degradation. Current forms of land degradation include overgrazed pasture areas, over-harvested bush, shrub and tree vegetation, soil erosion through excessive run-off and soil fertility decline, eventually causing land slides and mudflows. Most affected by degradation is village-near pasture land as well as bush and tree vegetation. Common causes are ineffective pasture management and lack of energy resources. Land degradation not only affects agricultural productivity, biodiversity and wildlife, but also increases the likelihood for natural hazards.

So far, there is no concerted effort to sustainably manage natural resources and mitigate land degradation in these areas. In this respect, a comprehensive GIS database will serve as an important tool for awareness building, coordination and monitoring of activities in the field of natural resources management and mitigation measures. Moreover, the four watersheds are sources of important international rivers crossing Uzbekistan and Kazakhstan before eventually reaching the Aral Sea. Sustainable watershed management is thus not only essential to the livelihoods of Tajikistan's population, but will also benefit agriculture and power generation in down-stream countries.

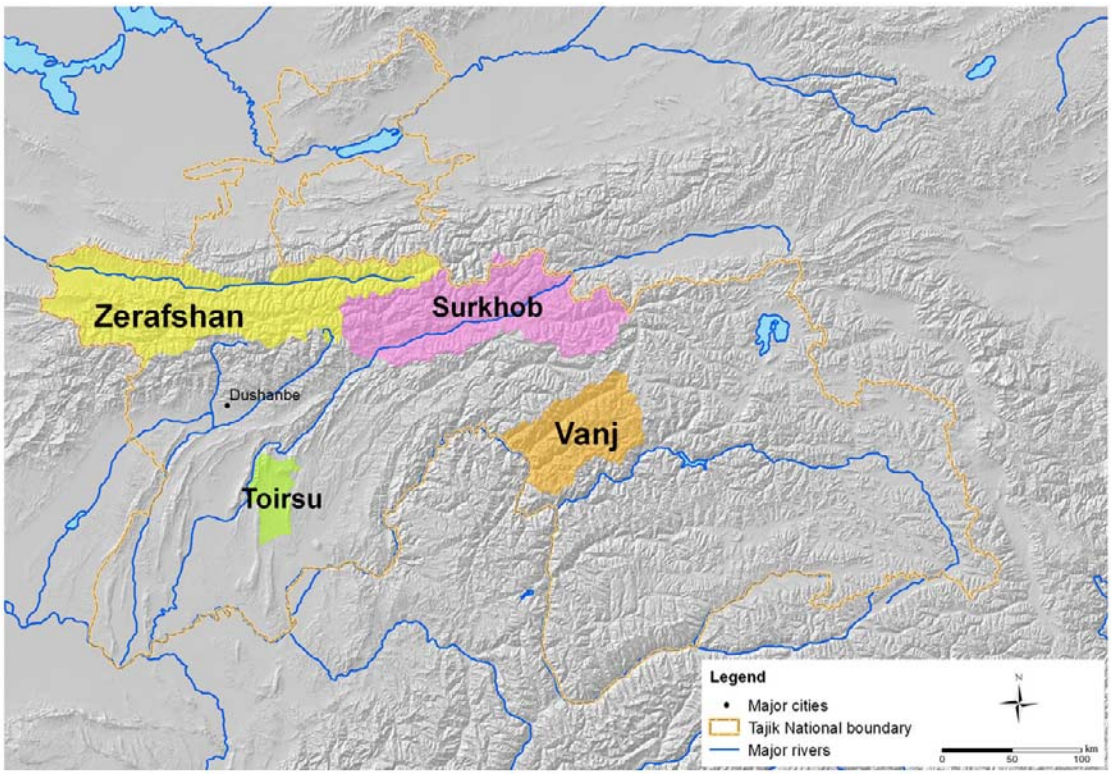


*Figure 1: Overview of project areas – the four watersheds of Zerafshan, Surkhob, Vanj and Toirsu rivers*

## 1.2 Objectives and components of CDE's mandate

### 1.2.1 Objectives

The overall goal of CDE's mandate is to build capacity in the use of geospatial tools and data for natural resources management in Tajikistan. The three major objectives are:

1) To analyse historic land degradation trends in the four watersheds of Zerafshan, Surkhob, Toirsu, and Vanj, and to compile a comprehensive database in a Geographic Information System (GIS);
2) To conduct training courses for the enhancement of local skills in the application of GIS;
3) To avail inexpensive geospatial tools and data to institutions and stakeholders concerned with sustainable natural resources management.

CDE's technical assistance is expected to improve the knowledge base and skills of local partner institutions and to strengthen agricultural and infrastructural development as well as emergency and environmental management.

CDE is mandated by the WB through two different funding lines: The Swiss Consultant Trust Fund (CTF) and the Bank-Netherlands Water Partnership Program (BNWPP).

### 1.2.2 The Swiss Consultant Trust Fund (CTF) Support

The Swiss CTF support, covering the period from July to December 2007, comprises the following tasks:

1) Analysis of historic land degradation trends in the four watersheds of Zerafshan, Surkhob, Toirsu, and Vanj;
2) Translation of standard CDE GIS training materials into Russian and Tajik to enable local government staff and other specialists to use geospatial data and tools;
3) Demonstration of geospatial tools that show land degradation trends associated with land use and vegetative cover data in the project areas,
4) Preliminary training of government staff in using appropriate data, including existing information, global datasets, inexpensive satellite imagery and other datasets and web-based visualization tools like spatial data viewers, etc.

This allows building local awareness of, and skills in, up-to-date, inexpensive, easy-to-use GIS technologies, data sources, and applications relevant to natural resource management and especially to sustainable land management. In addition to supporting the implementation of the WB technical assistance activity to build capacity in the use of geospatial tools for natural resource management, the Swiss CTF support also complements the Bank supervision work on the ongoing CAWMP.

### 1.2.3 The Bank-Netherlands Water Partnership Program (BNWPP)

The BNWPP will allow continuing this technical assistance initiated by the Swiss CTF support and extending the project in 2008. Building on the achievements and preliminary results of the Swiss CTF support, the BNWPP proposes to:

1) Conduct advanced land degradation analysis in the four watersheds of Surkhob, Zarafshan, Vanj and Toirsu;
2) Reinforce and expand capacity development of partner institutions in geo-information management;
3) Enhance the awareness of high-level policy makers and national scientists about the potentials of geo-information technology, the extent of natural resource management degradation, and the need for follow-up development programs and policies to improve natural resources management.

While the Swiss CTF support aims at providing baseline information and preparing a concept for capacity development and awareness creation, the proposed activities within the BNWPP will increasingly take into consideration the sustainable institutionalization of geo-information management in relevant Tajik governmental offices and WB partner institutions. A key point in this respect will be the setting up of a spatial information exchange platform, an initiative that has to be prepared during the Swiss STF support already.

## 1.3 Institutional set-up

The World Bank's Community Agriculture and Watershed Management Project (CAWMP) is managed by a Project Management Unit (PMU) located at the *Republican Center for the Farm Privatization Support under the Government of Tajikistan* in Dushanbe. Activities in the project areas are coordinated accordingly by watershed-based Project Coordination Units (PCU). In Addition, for each of the four watersheds a facilitating organisation has been contracted by the Bank for implementing project activities: the *Welt Hunger Hilfe (WHH, formerly known as German Agro-Action)* for Zerafshan watershed, the *United Nations Development Programme (UNDP)* for Surkhob watershed, the *Aga Khan Foundation (AKF) / Mountain Societies Development and Support Programme (MSDSP)* for Vanj watershed, and the *Food and Agriculture Organisation (FAO)* for Toirsu watershed.

CDE has been mandated by the World Bank Group on the one hand to provide technical assistance in the field of GIS to the CAWMP, and on the other hand to build up capacity in the use of GIS for natural resources management in Tajikistan in general.

## 1.4 Project inception

The inception report is based on the findings from the first major visit of CDE to Tajikistan (5-20 August 2007) taking into account earlier desk work undertaken since project start in July 2007.

### 1.4.1 Objectives

The inception report discusses the following project relevant issues:

1) Stocktaking of existing local data, software and hardware systems, GIS facilities and skills already available in Tajikistan (see *Chapter 2.1*),
2) Identification of inexpensive information sources and geospatial tools which are readily accessible to undertake the specific analysis of land degradation trends (see *Chapter 2.2*),
3) Recommendations for project implementation; i.e. rescheduling project activities, use of open-source GIS software versus commercial GIS software, appropriateness of web-based GIS database under present conditions, and awareness creation and capacity development (see *Chapter 3*),
4) Proposed activities; i.e. short description of the procedure for historic land degradation trends analysis with GIS, systematic evaluation of open-source GIS software, awareness creation and training workshop, proposed list of contents for the final report, and updated

detailed schedule and plan for all outstanding activities financed by the Swiss CTF (see *Chapter 4*).

### 1.4.2 Inception mission

The inception mission took place from 5 – 20 August 2007 and was conducted by Mr. Tobias Hoeck of CDE and Mr. Manuchehr Rahmatdzhonov (local assistant), in close collaboration with the PMU of the CAWMP in Dushanbe (especially with Mr. Rustam Rahimov, land management specialist).

The mission's **objectives** were:

1) Stocktaking of existing GIS data and facilities (software and hardware systems);
2) Identification of local GIS skills and capacities;
3) Identification of local partners' training needs;
4) Field visits to two watersheds (Zerafshan and Toirsu).

Stocktaking of existing local facilities, capacity and data was conducted with the help of a questionnaire for GIS and remote sensing assessment. Field visits to Zerafshan and Toirsu watersheds were used for selective ground verification of land cover, erosion and land degradation. Furthermore, they offered the possibility to meet with regional representatives of the watershed-based PCU of the CAWMP and facilitating organizations.

The reader is referred to the **annex** for:

a) GIS fact sheets of visited institutions, and
b) a list of visited government institutions and international organizations during inception mission.

# 2 Results

## 2.1 Stocktaking of local facilities, capacity and data

The stocktaking of existing data, software and hardware systems, as well as skills already available in Tajikistan focused on government institutions and not on international non-governmental organisations (NGO), since it is at government level that capacity building in use of geospatial tools and data is most needed. This chapter gives a general overview of local institutions, GIS skills and available data. Detailed information for each institution can be found in the **annex** (see *GIS fact sheets of visited institutions*).

### 2.1.1 Facilities and capacity

#### Institutions equipped with GIS technology

Seven government institutions and one non-governmental organisation, already working with GIS technology, have been identified and visited during the inception mission. They are listed in *Table 2*, which is briefly depicting available hardware and software, and the thematic focus of their work. The comprehensive questionnaire used for GIS and remote sensing assessment for each of the visited institutions and organizations during the inception mission can be found in the annex.

*Table 2: Institutions with GIS capacities visited during the inception mission*

| Government institutions | GIS hardware | GIS software | Thematic focus |
|---|---|---|---|
| Republican Center for the farm privatization support under the Government of Tajikistan (PMU of CAWMP) | Laptop computer<br>A0-format colour scanner & plotter | ArcView 3.1<br>(Russian edition) | Agriculture & watershed management |
| Soil Science Research Institute (SSRI), Tajik Academy of Agricultural Sciences (TAAS) | Desktop computer<br>A0-format colour plotter<br>A3-format scanner<br>4 GPS receivers | MapInfo Prof.<br>ArcView 3.2<br>ArcGIS 9.2<br>(English editions) | Soil sciences |
| The State Project Institute for Land Management "Tojikzaminsoz" (formerly known as GIPROZEM) under the Agency for Land Management, Geodesy and Cartography | Desktop computers<br>A0 format colour scanners (2) & plotters (2)<br>5 GPS receivers | ArcView 3.2<br>ArcGIS 8<br>(English editions) | Land use & soil surveys |
| Project Research Institute FAZO under the Agency for Land Management, Geodesy and Cartography | Desktop computers<br>A0-format colour scanner & plotter<br>1 plain scanner<br>2 high precision GPS receivers<br>2 theodolites | ArcView 3.2<br>ArcGIS 8<br>(Russian & English editions) | Land cadastre |
| Strategic Research Centre under the President of the Republic of Tajikistan | Desktop computers<br>A4 format colour scanner | ArcGIS 9.1<br>(English edition) | Socio-economic analysis |
| Tajik Research Institute of hydraulic engineering and land reclamation (TajikNIIGiM) | Desktop Computer<br>A0-format colour scanner & plotters (2) | Had ArcView 3.2<br>(no more available) | Land reclamation |

| Government institutions | GIS hardware | GIS software | Thematic focus |
|---|---|---|---|
| Ministry of Emergency Situations and Civil Defence of Tajikistan, Information Management and Analytical Centre (IMAC) | Desktop Computers<br>WebServer<br>A0-format colour plotter<br>A3-format colour scanner | ArcGIS 9.2<br>ERDAS<br>(English editions) | Disaster & risk management |
| **Non-governmental organisations** | **GIS hardware** | **GIS software** | **Thematic focus** |
| The Agency for Technical Cooperation and Development (ACTED) | Handed over their equipment to the CCDR | Handed over their equipment to the CCDR | Disaster preparedness |
| Centre of Competence for Disaster Reduction (CCDR)* | A0 format colour plotter<br>1 GPS receiver | ArcView 8.3<br>(English edition) | Disaster preparedness |

* The CCDR has not been visited during the inception mission.

In addition to the two departments visited during the inception mission (Tojikzaminsoz and FAZO), the Agency for Land Management, Geodesy and Cartography (Tojikkoinot) also includes the following departments: the AreoGeodesy Enterprise, the Scientific Research Centre, the Cartographic Factory and the State Enterprise "Markazi Zamin" (for organisational structure of the Tojikkoinot see *Figure 2*). A GIS strategy for Tojikkoinot has been elaborated by the GeoData Institute (University of Southampton, UK) and the UN Coordination Unit in Tajikistan, which is described in a draft report by Saidov et al. 2007. According to this report, there is currently no GIS equipment available in these departments. However, it is proposed to equip the AreoGeodesy Enterprise, the Scientific Research Centre and the Cartographic Factory with GIS infrastructure by the end of 2007. Furthermore, it is known that other non-governmental or international organisations such as the AKF/MSDSP, FOCUS, FAO, CARE or UNICEF are also working with GIS technology. However, they have not been visited during the inception mission.

*Figure 2* is an attempt to display an overview of institutions using GIS, their interrelations and involvement in the CAWMP. This institutional mapping is neither final, nor exhaustive.

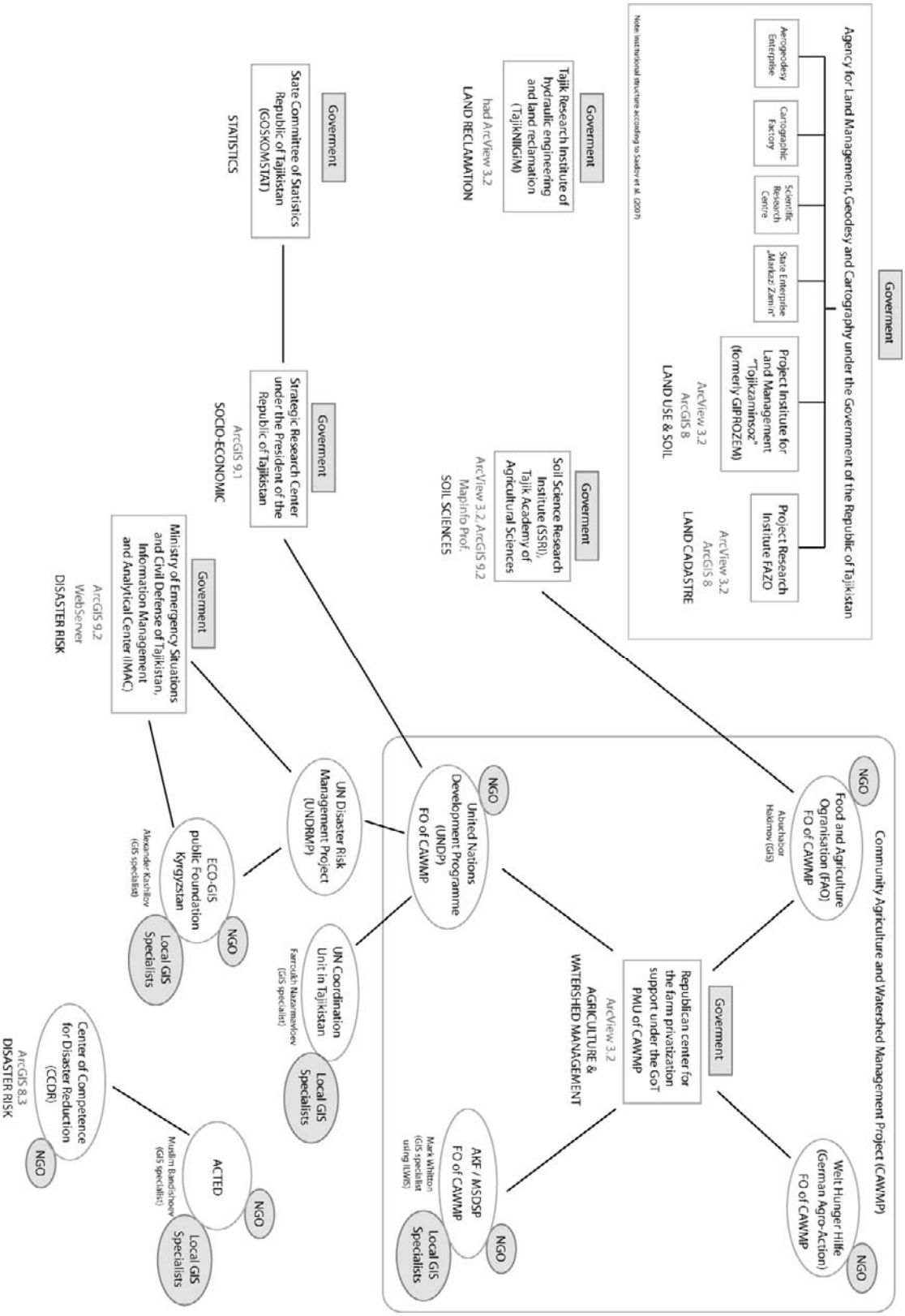


*Figure 2: Overview of institutions using GIS, their interrelations and involvement in the CAWMP. Note: this is a preliminary and non-exhaustive version.*

## Available hardware

**Computer workstations**: Computers are running with a Russian edition of the operating systems Windows Professional or WindowsXP. In general, they can be characterized as common desktop computers, not specially tuned for GIS work.

**Scanners:** Wide-format colour scanners (Vidar TruScan Titan or Select) are widely distributed among the institutions. They allow scanning of up to A0-sized paper maps and thus enable the institutions to digitize maps from their archives. SSRI and IMAC only have an A3-format colour scanner, which makes it more difficult to scan large-format paper maps. The Strategic Research Centre owns a usual A4-format office scanner.

**Plotters and printers:** All institutions, with the exception of the Strategic Research Centre, have a wide-format plotter (HP designJet 450, 500, 750 or 800) that allows printing of detailed maps on A0-sized paper.

**GPS receivers:** Handheld GPS receivers (Garmin GPSmap 60 and 76) are available within the Tojikzaminsoz, the SSRI, and the CCDR. Two high precision GPS systems (Leica GPS systems 500) together with two theodolites are used at the Project Research Institute FAZO within the framework of the EU TACIS technical assistance in the field of photogrammetry and geodesy.

**WebServer:** Only one WebServer has been identified in all visited institutions. This general-purpose tower server (Dell PowerEdge 800) is located within the IMAC, and currently offers the only possibility to locally host and maintain a web-based GIS database.

**Internet access:** Internet is mostly accessed through dial-up connections with weak data transfer capacity. Loading the web-based PamirGIS (www.pamir-gis.info, prepared by the CDE) was sometimes possible, however only with great patience. At present, the Tojikzaminsoz, the Research Project Institute FAZO and the TajikNIIGiM have no access to Internet at all.

In most institutions, the available hardware is suitable to perform basic GIS workflows including scanning, digitizing, editing and plotting. However, as soon as resource–intensive GIS packages are installed, efficient work may be heavily restricted by the computers' performance. The number of workstations in each institution is generally limited and only one or two people can work with GIS (an exception is FAZO, where up to 20 persons are working on the vectorisation of paper maps). Poor or no Internet access at present requires additional distribution channels for GIS data other than only via a web-based database.

## Available software

**GIS software:** The most common GIS software used by the visited institutions is ArcView and ArcGIS from ESRI. There is a large variety of versions available, ranging from ArcView 3.1 and 3.2 to ArcGIS 8, 8.3, 9.1 and 9.2, all with an English language user interface. Non-

licensed Russian and English editions of ArcView and ArcGIS are also used. The only alternative GIS product, MapInfo Professional, is available at the SSRI.

**GPS software:** DNR Garmin, OziExplorer and SKI-Pro (Leica).

**Software licences:** The high license costs for GIS software were generally covered by international donors through project budgets and thus provided to the government institutions. Commonly, one or two single-use licenses (restricted to one workstation) are available within one institution; Work with GIS is therefore limited to a small staff. Non-licensed products are also in use.

**Language issue:** The Russian language user interface for GIS software is preferred to the English one. Nevertheless, people with limited English languages skills also manage to work with the English edition. Still, it has to be considered that if a Russian version is available, people will tend to continue using it, rather than to switch to new software with an English user interface.

In general, the current software equipment of the visited institutions seems to fulfil the existing needs. In certain cases bottlenecks may exist due to the modular structure of most software packages: For example a simple ArcView 3.x version is restricted to pure vector editing, while all raster manipulation tools have to be licensed in an additional extension.

### Available skills

A broad range of GIS activities is implemented by the visited institutions, including scanning of paper maps, capturing of vector data, digital editing, adding of attribute data, integrating GPS waypoints from field surveys, and printing of elaborated maps. Of course, there are differences between the institutions in the application of these work steps depending on their equipment and field of competences. In general, GIS skills are still limited to basic application of geospatial tools. It was observed that the following work steps need to be strengthened:

- Adding attribute data, i.e. integrating statistical data into GIS databases
- Geo-rectification of scanned maps and satellite images
- Image processing, including image enhancement, classification and feature extraction
- Basic modelling steps using geo-processing tools

**Remote sensing:** With the exception of ACTED, which used a satellite image (QuickBird) of the City of Dushanbe as a basis for their Disaster Preparedness ECHO project, satellite images and remote sensing technology for geospatial analysis are not yet used in the visited institutions.

**Personnel:** GIS staff is commonly very small: there are usually only one or two persons with comprehensive GIS skills in each institution.

**Local GIS specialists** have been identified with the following organisations:

- ACTED: *Mr. Muslim Bandishoev*, who worked on the Disaster Preparedness ECHO project, already compiled GIS training materials and conducted training courses.
- UN Coordination Unit in Tajikistan: *Mr. Farroukh Nazamavloev*, who is in charge of the GIS Coordination, and already conducted GIS training courses.
- ECO-GIS Public Foundation, Kyrgyzstan: *Mr. Alexander Kashilov*, who is currently providing support in use of GIS and database to the IMAC.
- AKF/MSDSP: *Mr. Mark Whitton*, who has experiences with ILWIS, an open-source GIS software (http://www.itc.nl/ilwis) and is applying it in GIS and RS approaches for the management of CAWMP activities ongoing in the Vanj watershed.

### 2.1.2 Local data

#### Paper maps & statistics relevant for geospatial databases

The *State Committee of Statistics* holds a large archive of socio-economic and census data. Compiled statistics of population, agriculture, transport, education, trade, etc. are published as (annual) reports and are for sale in their bookstore. It proved to be difficult to obtain statistics at jamoat and village levels. On request, it is possible to receive statistical data also in digital format (i.e. excel files).

*The Project Institute FAZO* holds an archive of land cadastre and settlement maps (on a scale of 1:10'000), which are currently digitized and updated.

*The Tojikzaminsoz (formerly known as GIPROZEM)* runs an archive including air photographs and paper maps on scales of 1:10,000 and 1:20,000. Thematic focus is on land cover and land use, agricultural land cadastre, economic appraisal of land and soil, and geo-botanical characteristics.

T*he Soil Sciences Research Institute* holds a stock of soil, erosion and vegetation maps including a thematic soil atlas (encompassing two tomes from 1984) on a scale of 1:500,000.

*The Tojikkoinot:* A comprehensive list of available cartographic materials in the archives of the Tojikkoinot is depicted in Saidov et al. 2007, covering thematic topics such as natural resources, land cover, vegetation, natural hazards, geology and geomorphology, glaciology, melioration and land development on scales of 1:500,000, 1:200,000 as well as 1:50,000.

*The Agency on Hydrometeorology (www.meteo.tj)* holds a large archive of climatic and meteorological statistics (precipitation, temperature, humidity, etc. from 57 meteorological survey stations). Data is available in paper or digital format and can be ordered according to a well-defined procedure.

## Digital data

*The IMAC* is currently digitizing 1:500,000 paper maps from 1984. The different sheets are compiled to form country risk maps on a scale of 1:3,000,000. So far, eight maps with the following topics have been completed: Engineering geology (exogenous geological process and phenomena), land use, avalanches, surface waters, seismic zones, disaster risk zones, settlements, and administrative units. Furthermore, it is foreseen to prepare risk maps based on 1:200,000 topographic maps, too.

*The Strategic Research Centre* is creating socio-economic maps depicting statistical data at oblast, district and jamoat levels. These maps are available in PDF format at www.src.gov.tj or at www.untj.org .

*ACTED* created a city map of Dushanbe for disaster preparedness based on satellite images (QuickBird) and GPS surveys.

*Table 3: Local data relevant for geospatial databases*

| Institution | Paper maps & statistics | Digital data |
|---|---|---|
| Tojikkoinot | Paper maps on natural resources, land cover, vegetation, natural hazards, geology and geomorphology, glaciology, melioration and land development on scales of 1:500,000, 1:200,000 as well as 1:50,000 (see Saidov et al. 2007) | |
| Project Institute FAZO | Land cadastre and settlement maps on a scale of 1:10,000 | Land cadastre and settlement maps are being digitized |
| Tojikzaminsoz | Air photographs and paper maps on land cover and land use, agricultural land cadastre, economic appraisal of land and soil, and geo-botanical characteristics (on scales of 1:10,000 and 1:20,000) | Paper maps are being digitized |
| SSRI | Soil, erosion and vegetation maps including a thematic soil atlas on a scale of 1:500,000 | |
| IMAC | | Paper maps (1:500,000 from 1984) are being digitized and compiled to form country risk maps on a scale of 1:3,000,000. |
| Strategic Research Centre | | Socio-economic maps depicting statistical data at oblast, district and jamoat levels |
| State Committee of Statistics | Statistics of socio-economic and census data | Current statistics in digital format (excel files) |
| Agency on Hydrometeorology | Climatic and meteorological statistics (precipitation, temperature, humidity, etc.) from 57 meteorological survey stations | Statistical data available in digital format |
| ACTED | | City map of Dushanbe, satellite image (QuickBird) of the city area |

Note: This is a preliminary and non-exhaustive list.

### Data accessibility

In general, statistical data and paper maps on large scales are officially considered secret and not accessible. This includes paper maps on a scale of 1:100,000 and larger, as well as statistical data at village level. Moreover, there is very rarely a defined procedure on how to obtain or buy data and maps from institutions. The official maps available for sale in stores are relatively expensive compared to their quality, and usually only include political and topographic maps on smaller scales. The publishing and distribution of digital maps apparently still lacks a legal basis. This has to be considered when working with Web-based GIS databases and spatial information exchange platforms open to the public or a group of licensed users.

## 2.2 Available spatial data and GIS software

During the last years the scientific community increasingly enjoyed the results from efforts initiated by governments and research institutions to make geospatial data available to the public. As a result the Unites States opened archives with valuable LANDSAT data, covering the early 1970ies, the 1990ies and the year 2000. Similar initiatives resulted in a growing number of geospatial clearinghouses, providing free and low cost data.

### 2.2.1 Geospatial data

#### Satellite imagery

Imagery data captured from space is an important source of information on the status and extent of spatial features linked to land degradation. While satellite imagery cannot measure land degradation itself, it provides spectral information on earth surface features such as land cover types. Depending on scale and nature of degradation to be analyzed the satellite imagery has to meet major conditions in terms of resolution and recording time. Such conditions comprise:

- Area coverage
- Resolution of satellite imagery (spatial, temporal, spectral)
- Determination of recording date
- Data availability and costs

Based on these conditions a combination of different sensors, such as LANDSAT, CORONA and potentially ASTER, is very promising for the analysis of land degradation trends (see *Table 4*). While high-resolution satellite imagery such as Ikonos and Quickbird are promising data sources for impact monitoring of project activities on small field plot, as carried out by the CAWMP project, their high costs prevents applicability to assessments over large watersheds. However, two to three case studies including high resolution satellite imagery could be carried out for methodological and demonstrative purposes, within the follow-up project financed by the BNWPP.

*Table 4: Selected satellite data covering the project areas*

| Sensor | Area coverage | Spatial Resolu-tion (in metres) | Spectral Resolution | Archive | Costs | Source |
|---|---|---|---|---|---|---|
| Landsat ETM+ | Full coverage in 2000 ±2y | 15 – 60 | 0.45 – 12.5 micrometers (8 bands) | 1999 – 2007 (limited since May 2003) | Free of charge for 2000 ±2y dataset, 300-600.- US$ other scenes | www.landcover.org http://glovis.usgs.gov |
| Landsat TM | Full coverage in 1992 ±2y | 30 – 120 | 0.45 – 12.5 micrometers (6 bands) | 1982 (LS4) – 2007 (LS5) | Free of charge for 1992 ±2y dataset, 425.- US$ other scenes | www.landcover.org http://glovis.usgs.gov |
| Landsat MSS | Full coverage in 1972 ±2y | 60 | 0.45 – 12.5 micrometers (4 bands) | 1972 (LS1) – 2007 (LS5) | | www.landcover.org http://glovis.usgs.gov |
| ASTER | Full coverage in 2004 ±3y | 15 – 90 | 0.52 – 11.5 micrometers (14 bands) | 1999 – 2007 | 85.- US$ / scene | http://glovis.usgs.gov |
| CORONA | Full coverage in 1970 & 1980 | 2 – 8* | 15 – 60m (1 band) | 1959 – 1980 | 30.- US$ / scene | http://eros.usgs.gov |
| Quick-bird | Partial coverage 2002-2007 | 0.6/2.4 | 0.45 – 0.9 micrometers (4 bands) | 2002 – 2007 | 16 to 45.- US$ / km² | www.digitalglobe.com |
| Ikonos | Partial coverage 2001-2007 | 1/4 | 0.45 – 0.85 micrometers (4 bands) | 2000- 2007 | 25 to 60.- US$ / km² | www.geoeye.com |

* panchromatic

### Topographic information

Only few topographic datasets cover the areas of interest (see *Table 5*). Besides a small scale (1:1,000,000) dataset based on a global data sampler compiled by USGS, UNDP Tajikistan is ordering a digital geospatial database on a scale of 1:200,000, digitized from Russian military maps updated in the early 1980ies. This database comprises thematic vector layers (hydrology, transportation infrastructure, elevation information) and derived layers, such as a digital elevation model, a rainfall layer and a watershed layer.

Other valuable datasets include the digital elevation model derived from the Shuttle Radar Topography Mission (SRTM) that is available from NASA and the climate dataset available from worldclim (www.worldclim.org).

### Other data

Information on soil types covering Tajikistan is mostly available as paper maps dating back to Soviet times. Parts of them have been digitized by CDE.

Census data on socioeconomic topics is available for sale from the Tajik State Committee of Statistics; however this data has only partly been processed in a digital manner.

*Table 5: Thematic datasets covering the project areas*

| Dataset | Topic | Scale / spatial resolution | Availability / costs | Source |
|---|---|---|---|---|
| USGS thematic data sampler | Topographic, biophysical and socioeconomic data | Vector 1:1,000,000 and Raster 1-5 km | 100 US$ | http://www.usgs.gov |
| Tajik national database (UNDP) | Topographic, thematic and climatic data | Vector 1:200,000 and Raster 50 – 500m | Contact UNDP Tajikistan | www.undp.tj www.untj.org |
| SRTM | Digital elevation model | Raster resolution 90m | Free of charge | http://srtm.usgs.gov/ |
| Worldclim | Global climate data | Raster resolution 1km | Free of charge | http://www.worldclim.org/ |
| Tajik soil data | Thematic paper maps with soil information | Mapscale 1:500,000 | Contact SSRI | |

The Tajik National Database (see *Table 5)* compiled by order of UNDP Tajikistan will possibly be a first step towards a nationwide spatial data infrastructure. It encompasses geospatial information on settlements, road infrastructure, climate, hydrology and topography, digitized from Russian military maps (scale 1:200,000). With combined efforts, this database can be further enhanced to provide a solid basis for spatial decision support and a tool that meets the needs of different stakeholders.

There are two additional digital datasets, however covering only parts of the project areas:

1) The **Pamir WebGIS** (developed by CDE: www.pamir-gis.info) providing mainly topographic information layers covering the eastern part of Tajikistan (Pamir Mountains).

2) **VMAP1** (topographic vector data level 1) dataset covering the south-western parts of Tajikistan (www.mapability.com).

### 2.2.2 GIS / remote sensing software

GIS and remote sensing software have to meet various requirements; first of all they have to contribute towards a user-friendly, powerful tool for spatial data processing. Any defined processing workflow should be easily implemented in a stable environment. To ensure the sustainability of software use under present conditions prevailing in developing countries, one has to overcome the prohibitive restrictions of proprietary licensed commercial software. The likely solution will thus be an open or low cost software type.

From an operational point of view the following open-source GIS tools satisfy the above-mentioned criteria:

### 1) ILWIS (Integrated Land and Water Information System)

ILWIS (www.itc.nl/ilwis) integrates vector, raster and thematic data in one powerful desktop application. It provides a wide range of features including digitizing, editing, analysis, import/export and display of data, as well as compilation of maps. It has to be noted that ILWIS was only recently released under an open-source license.

### 2) QGIS (Quantum GIS)

Quantum GIS (QGIS, www.qgis.org) runs on Linux, Mac, and Windows. Once accustomed to, it is a user friendly open-source GIS supporting vector, raster, and database formats (e.g. ESRI ShapeFile, geotiff). Using plugins, QGIS provides access to a vide range of powerful raster features only available to GRASS (Geographic Resources Analysis Support System) users before.

### 3) SAGA (System for Automated Geoscientific Analyses)

SAGA (www.saga-gis.uni-goettingen.de/html/index.php) is another open-source initiative with the primary objective to give scientists an effective but easy learnable platform for the implementation of geo-scientific methods. It supports an impressive range of functions and is extendable using SAGA's Application Programming Interface. The tools are mainly accessible through an easy to use Graphical User Interface.

There are also other open-source GIS tools; however they are less adapted to the specific needs of the project than the ones discussed above. Ultimately, a selection of GIS software for capacity development, analysis of soil degradation and institutionalisation of geo-processing activities among partner institutions in Tajikistan will not only depend on the technical capabilities of these tools, but also on the requirements of planned project workflows, institutional acceptance and usability.

# 3 Recommendations

The following recommendations are based on the stocktaking carried out during the inception mission, previous experiences of CDE in Tajikistan in the frame of development and research partnership programmes, as well as careful analysis of various options for the implementation of the mandate. Six main recommendation lines have been identified:

1) the definition of a long-term objective for GIS capacity development in Tajikistan,
2) the logical sequence of activities to be performed in the frame of the mandate,
3) the setting up of a backstopping link between partner institutions and CDE,
4) the choice of GIS software options,
5) the setting up of a web-based tool, or spatial information exchange platform
6) the conducting of awareness creation and capacity development activities

Some additional recommendations concern the impact of conducted activities and the sustainability of the project.

## 3.1 Definition of long-term objective

Training in the use of geospatial tools has been carried out repeatedly, in Tajikistan and elsewhere, with varying degrees of success and sustainability. Often, the lack of a strategy and the absence of long-term capacity development objectives lead to weak and non-sustainable training outcomes.

The inception mission and previous information from the WB have shown that poor exchange of data and experience among governmental institutions in Tajikistan is a major bottleneck for efficient utilisation of geo-information technology. Therefore, information exchange has to be an integral part of a capacity development strategy aiming at enhancing the use of geo-information technology for sustainable natural resources management. Therefore, CDE recommends defining the setting up of a spatial information exchange platform as the long-term objective for the initiated capacity development mandate. Such a platform, or hub, could be used for the exchange of spatial data, experiences, common capacity development initiatives, or for the pooling of application development resources, etc. But first and foremost, it is supposed to create the awareness among decision makers and technicians that there is a mutual benefit in exchanging information and contributing to the improvement of a common database.

**Recommendations**:

CDE recommends to define the setting up of an exchange platform for spatial information as the long-term objective of the capacity building in the use of geospatial tools for natural resources management aimed at through CDE's mandate. Consequently, it is recommended that the activities composing this mandate are geared towards this long-term objective.

## 3.2 Rescheduling of activities

CDE recommends rescheduling project activities for capacity development and awareness creation as foreseen within the frame of the Swiss CTF support (*Chapter 1.2.2*) and the BNWPP support (*Chapter 1.2.3*). In order to ensure a participatory approach, awareness creation for decision-makers about the potential of geo-information technology for natural resources management must be conducted previous to the training of local GIS staff, the main reasons being that:

1) Local partners (decision makers) must be well informed about the foreseen project activities and must be involved in the decision-making process about their implementation (land degradation database, open-source GIS software solutions, web-based GIS application, etc.);
2) The institutional set-up and technical requirements to host a Web-based GIS application in Tajikistan needs to be clarified. Additionally, consensus on the access to a common spatial information exchange platform must be sought in order to ensure sustainability;
3) Present and future GIS workflows of the different institutions have to be identified in order to clarify software solutions and specific capacity development needs.

Therefore, an awareness creation and training workshop rather than a technical GIS training course will be held in November 2007, immediately after the completion of the spatial database on soil degradation for the four watersheds (see also *Chapter 3.6*). This will help increasing the chances for a long-term impact of the foreseen capacity development efforts in Tajikistan.

**Recommendations:**

CDE recommends conducting the mandate under the Swiss CTF support according to the following logical sequence:

1) Elaboration of spatial database on historical land degradation trends
2) Evaluation of open-source GIS software
3) Decision-makers workshop and training in the use of the land degradation database
4) Elaboration of a concept for a web-based spatial information exchange platform
5) Elaboration of training concept and translation of training materials
6) Final report

## 3.3 Setting up a backstopping hotline

As soon as project activities have started, participating institutions should be able to raise questions and issues to a common technical backstopping institution, which would try solving technical issues and sharing technical experiences to all involved institutions through a mailing list. Based on its technical expertise and involvement in the project CDE proposes to take over this role and to actively support participating institutions for the entire duration of the mandate. After this period it is proposed to handover this task to a local GIS specialist.

**Recommendations:**

To set up a technical backstopping hotline and mailing list between CDE and institutions participating in the project

## 3.4 GIS software solutions

The ongoing discussion on the use of open-source and shareware software is a recurring issue for development projects dealing with GIS. Often opinions and arguments are rather based on personal preferences and points of view, or technical aspects than on a careful analysis of the institutional and personnel context in which these tools are supposed to be implemented.

Note: Shareware is defined as software that is available free of charge, but the source code of which can not be accessed by the end user. One example is the ArcReader application, which can be downloaded for free from the ESRI website and, which enables users to view and query pre-processed spatial data. Open-source software enables the user to actively modify the source code of the software and therewith contribute to its development. One example of an open-source GIS software is ILWIS.

The current predominance of commercial GIS packages in developing countries is mostly based on illegal license practises, "biased" GIS project management decisions and small advertisement budgets from open-source software providers. Once established, it is evidentially difficult to replace one system with another, even if it is shareware. In some cases the latter are also rejected because freely available software packages are generally viewed as being less powerful, less user friendly and less adapted to the institution's needs than commercial solutions. Beyond these perceptions that are often subjective, there are a number of criteria to consider before deciding in favour or against open-source GIS. These criteria are listed and commented below (OS indicates arguments in favour of the use of Open Source software; CO indicates arguments in favour of the use of Commercial software):

### 1) Independence

OS Commercial software is creating dependencies. All users depend on the software producer, even if the licenses are granted for free, as it is the only institution deciding on the further development of the software.

CO Software like ArcGIS and ArcView are designed in a way to enable users to develop own extensions and scripts that can perform specific tasks within the software's own environment. Thus users can contribute to the software development even without having access to the source code.

### 2) Costs

OS There are no direct costs for open-source software. Nobody is being charged for using, implementing or improving open-source software. Since the program code is openly available, costs can be reduced by adapting the software internally. Even when external

experts are hired for programming, access is guaranteed to the product after programmers have left. The costs argument is especially important for developing countries, since prohibitively high licensing costs exceed the budget of government institutions and most NGOs by far.

CO The investment that is sometimes required to adapt shareware software to an institution's specific needs, and that may include training, consultancy and programming costs, can equally be a hindrance. The more complex and specific the geo-processing task to be performed is, the more likely it is that available open source applications will need to be enhanced.

### 3) Community

OS Most of the open-source projects profit from active user communities. This means support may come from commercial support packages, email lists or books. One of the most powerful aspects of such supporting communities is that they are also interested in the product. So there are immediate allies for troubleshooting and changing ideas. Once shortcomings are noticed, any discoverer may help to define the problem and even fix it. Developers and like-minded users are able to cooperate and share code parts. Generally, open source communities are very active and a great source for innovative solutions.

CO For the same reason, one could argue that open source solutions are rather an option for innovative institutions working on application development than for governmental institutions interested in applying a ready made tool to carry out specific tasks they are in charge of. Even in industrialised countries, government agencies usually outsource the application development tasks to consultants or specialised institutions.

### 4) Innovation

OS Open-source projects are pushing innovations. Being part of a community it is easier to define needs and new ideas and suggest changes to the developers. Innovative applications are not restricted to open-source projects, but technology using closed-source software is not as stretchable as open-source products. Using open-source software, the underlying technology can be customised and improved according to the actual needs. And last but not least it is a fact that customised software is highly demanded.

CO As was mentioned above innovation and the further development of software applications is demanding, requires specialised staff and is not necessarily of interest to implementing agencies in the South, which are rather concerned with acquiring tools that will help them solve development problems in the most efficient manner.

### 5) Freedom

OS There are different licensing models open-source projects can use. All licenses have in common the freedom to use as many copies of the software on as many computers as

needed. For programmers the increased freedom is indubitable. So the programmer may choose to incorporate previously developed code parts or to share the product with others, and in turn receive help maintaining it.

CO The management of dynamic tools is more demanding. Relying on commercial software, as is the case for an overwhelming share of non-GIS applications (Office, Graphics, etc.), has the advantage that institutions benefit from standardised updates from the software producer, which also reduces the risk of incompatibilities between different versions of the same software.

It will be part of the present project to systematically evaluate the advantages and disadvantages of existing open-source GIS software (see also *Chapter 4.2*). This evaluation will have to reflect the different types of use to be made of GIS software in the frame of the project and by the project's main partner institutions:

1. GIS for the analysis by CDE of soil degradation in four watersheds and the setting up of a spatial database
2. GIS for the development of spatial analysis capacity of partner institutions offered by CDE in the frame of the project
3. GIS for continued use by Tajik partner institutions after project completion as a way of supporting sustainable land management and soil conservation
4. GIS for setting up a Web-Based spatial information tool to be hosted by a Tajik partner institution

**Recommendations:**

- To assess the GIS based workflow for each of the above types of use and identify possible software solutions
- To assess the short and long term costs linked to the licensing of commercial software and adaptation of open-source software to partner institutions' requirements
- To assess existing preferences, expertise and investments necessary for developing GIS capacity and software management skills in partner institutions
- To target individual solutions for each institution based on the above assessments

## 3.5 Web-based GIS tool

The emergence of the internet in the domain of GIS is closely linked to the process of differentiation between users and developers. The power of Web-based GIS applications is their ability to illustrate complex thematic data in interactive maps. All complex calculations and data processing steps are done by the web GIS developer. This means that for viewing the data on the internet neither GIS knowledge nor expensive software are necessary.

However, an internet connection with a high bandwidth is necessary to run such a system. Since this crucial requirement is at present rarely met in developing countries, Web-based GIS applications targeting these countries are seldom. This is also the case for government

institutions in Tajikistan; they are often confined to low bandwidth or even lack a dial-up internet connection.

CDE has already set up a web mapping and data distribution service within the framework of a former project for the Pamir Mountains (www.pamir-gis.info) in 2005 that is hosted in Switzerland. Experiences have shown that this tool is not widely used or known by institutions in Tajikistan. Main reasons are the slow internet uplink between Europe and Tajikistan (small bandwidth), lack of high bandwidth connections to the internet, which would allow comfortably using this service in Tajikistan, and the fact that the information tool is not available in local languages.

To overcome these constraints the web GIS application should be hosted in Tajikistan and made available also in Russian and Tajik. Consequently, a local institution is needed, which has already a web server or the possibility to run one, as well as the capacity to maintain a web-based GIS database. In order to set up a usable and sustainable web GIS application, the following aspects have to be considered:

1) The web mapping application must be hosted in Tajikistan. At the moment, the IMAC is the only known institution that seems to have the required infrastructure.
2) A local web server administrator or web application programmer must be trained to maintain and preferably also update the web mapping application.
3) Considering poor internet access digital data has to be disseminated to all interested institutions also on physical media such as CD-ROM or DVD-ROM.

**Recommendations:**

Due to the current technical and institutional context in Tajikistan, the usage of a Web-based GIS by partner institutions tends to be unlikely. In a first phase, it is therefore recommended to elaborate a concept for the implementation of an inexpensive demonstration version of the Web mapping application within a Tajik institution. Based on the agreements and findings from the awareness creation and training workshop, which will be held in November 2007, it will be possible to appraise its feasibility and define concrete next steps for its implementation and further pursuance as a spatial information exchange platform.

## 3.6 Awareness creation and capacity development

### 3.6.1 Training and awareness creation approach and contents

A participatory approach to awareness creation and capacity development has to be adopted in order to identify exact training needs, participating governmental and non-governmental institutions, as well as software options, and to settle various other issues, as for example the hosting of a Web-based tool and spatial information exchange platform. Therefore, CDE recommends starting this project component with a short awareness creation campaign at the decision-making level, followed by a consensus building process for the further designing of the capacity development effort and a brief training in the use of the land degradation

database. This first set of capacity development activities to be conducted before the end of 2007 in the frame of the Swiss CTF will be followed in 2008 by advanced capacity development at the technical level under the BNWPP. Such an approach will help enhancing the chances that capacity development efforts are sustainable and that institutions actively engage into incorporating geo-processing tools into their working procedures. CDE recommends including the following topics and activities to the capacity development event of November 2007:

- Launching the soil degradation database and demonstration tool prepared in the frame of the mandate's first component and presenting the Pamir Web-GIS tool created by CDE
- Introductory course on the usage, maintenance and further development of this database with technicians from the participating institutions.
- Consensus building process on the further development of the capacity development concept, the identification of GIS workflows of participating institutions, the concretisation of training needs, and the setting up of a spatial information exchange platform.

### 3.6.2 Beneficiaries

In order to help establishing a community of GIS users among governmental and non-governmental institutions in Tajikistan and to further enhance chances of sustainability, capacity development efforts should not be restricted to the CAPMW, or to any particular institution. Trainees should be drawn from governmental and non-governmental institutions based on these institutions' interest and commitment for the implementation of geo-processing tasks and on their topical fields of experience, which should be related to sustainable management of natural resources. CDE recommends including the following institutions, which already have experience with GIS to different degrees:

- *The Republican Center for the Farm Privatization Support under the Government of Tajikistan*
- *The Facilitating Organisations of the CAWMP (WHH, UNDP, AKF, FAO)*
- *Information Management and Analytical Centre (IMAC), Ministry of Emergency Situations and Civil Defence of Tajikistan*
- *Strategic Research Center under the President of the Republic of Tajikistan*
- *Soil Science Research Institute (SSRI), Tajik Academy of Agricultural Sciences*
- *Tajik Research Institute of hydraulic engineering and land reclamation (TajikNIIGiM)*
- *Tojikkoinot, Project Research Institute FAZO*
- *Tojikkoinot, Project Institute for Land Management Tojikzaminsoz (formerly known as GIPROZEM)*
- *Tojikkoinot, AreoGeodesy Enterprise, the Scientific Research Centre and the Cartographic Factory:* Dependent on whether these departments already received GIS equipment or not, it is recommended to include them into training and awareness creation, too.

**Recommendations**

- To start the capacity development effort with an awareness creation workshop for decision-makers, to which will be attached a short introduction course in the use of the land degradation database.
- To implement a GIS training for technicians of identified partner institutions in the frame of the BNWPP project.
- To include government and non-government institutions that are working in the broader frame of sustainable land management and that have already shown interest and commitment in implementing GIS technology.

## 3.7 Additional recommendations

### 3.7.1 Ensuring long-term impact

Creating a GIS database and conducting capacity development in GIS is, in itself, not a sufficient guarantee for a sustainable impact on working procedures and enhancement of sustainable land management. Especially when introducing new software, so far unknown to local GIS staff, continuous “on demand support” subsequent to the training course must be provided. This could be achieved by contracting a local GIS specialist for a certain period of time. Furthermore, additional training courses are needed in order to repeat and strengthen skills acquired and to further refine them. This will be an important component of the BNWPP support. Therefore CDE recommends identifying local consultancy competences for post-project backstopping and support.

### 3.7.2 Data distribution policy

A GIS database, including geo-referenced topographic map layers, digital terrain models, satellite images, or layers depicting ecological and socio-economic data, is a valuable basis to start working with GIS on any topic, be it land degradation, disaster preparedness or project management. Delivering such a database to a wide range of institutions will enable and encourage them to complement it with additional data. Therefore, it is recommended to impose no restrictions on the use and distribution of the database created within this project, and to actively distribute it among all interested stakeholders. In this context, it has to be considered that data distribution via internet will not be sufficient under present conditions. Additional distribution channels, such as CD-ROM or DVD-ROM must be taken into consideration.

# 4 Proposed activities

## 4.1 Analysis of historical land degradation trends

### 4.1.1 Preliminary considerations

As stated above the goal of the proposed activities is to analyse land degradation trends, based on a dedicated spatial database that will serve primarily the purpose of land degradation studies but may also support follow up activities not only limited to CAWMP.

The project approach focusing on the identification of robust ways of analyzing degradation in selected watersheds in Tajikistan shall be tested for feasibility. Principally based on open-source and low-cost satellite data relevant trends and drivers of degradation are to be disclosed. The approach to be developed is primarily aiming at effectiveness and applicability and will possibly not always satisfy scientific requirements especially with regard to model validation, since field survey activities can only be carried out to a certain limited degree. The potential of remote sensing methodologies applied in this project is important, especially since the archives storing multi-temporal data are increasing day by day. Further on, the application of geo-processing methodologies ensures the possible integration of thematic data such as soil layers or topographic parameters.

Literature shows that different approaches targeting land degradation have been developed. They include semi-quantitative assessments based on expert knowledge, such as the GLASOD (Global Assessment of Human Induced Soil Degradation) initiative that inventoried soil degradation on a global scale, based on (local) expert knowledge inquired by interviews and questionnaires. Quantitative approaches include physical and empirical land degradation models. A widely applied model for quantification of erosion rates is the universal soil loss equation (USLE) and its derivatives (RUSLE and MUSLE). While physical models are often very data intensive, the application of the USLE to locations for which no calibration of its components, the erosion controlling factors, has been conducted, has however been heavily criticised in recent years. For land degradation assessments in mountainous and highly heterogeneous environments, decision tree modelling has been successfully applied in a range of studies including both expert-knowledge and statistically based models. The most important advantages of decision tree models are, that they allow the integration of different types of datasets (vector and raster data), that these rule-based systems are closely linked to field procedures, where e.g. soil types are distinguished using hierarchical systems and thus facilitate inclusion of expert knowledge, and that they are non-parametric models, well suited for heterogeneous landscapes with typically highly non-normally distributed influencing factors. Finally, preliminary decision tree models of simple structure and a limited number of land degradation classes can easily be further developed and specified, as knowledge is gained within the course of the project.

### 4.1.2 Approach

A watershed-based approach will be adopted for the land degradation assessment conducted within this project. Land use and land management are strongly affecting land degradation processes, thus determining major land use types and analysing vegetation cover dynamics shall serve as an entry point to the analysis of land degradation. The procedure is based on the assumption that land degradation classification can be identified by a combined approach based on multispectral information and ancillary data, such as precipitation, soil parameters and topographic and hydrological arguments. The integration of land degradation factors will be based on decision tree modelling. Where applicable and available, local reference data will be included.

### 4.1.3 Main work steps

The following work steps will be carried out:

1) Establishing a database including a range of spatial datasets representing land degradation controlling factors.
2) Elaborating an expert knowledge based decision tree model determining the integration of land degradation controlling factors (a first version of the model will be elaborated by CDE, which will then be further discussed and elaborated in collaboration with participants of the GIS training course conducted within this project, see *Chapter 4.3*).
3) Preliminary validation using a limited number of ground truth points.

The follow-up project, financed by the BNWPP, will encompass inter alia an in-depth validation of the model results based on more detailed field work, followed by a refinement of the model according to the improved knowledge base.

### 4.1.4 Analytical framework

The degradation trend analysis will follow a multi – sampling strategy. First, today's degree of land degradation will be assessed based on recent satellite imagery and ancillary data. This part will include the following specific activities:

- Multispectral analysis of recent satellite imagery data, deriving key land cover classes controlling land degradation (e.g. vegetation stages, bare soil, rock outcrop…).
- Inference of land degradation classes using expert knowledge based classifiers, considering land cover information, topographic parameters (DTM) and ancillary data (e.g. thematic maps…).

Second, to allow for change detection, historic land degradation will be assessed based on the following analysis:

- Comparative analysis (change detection) of past and recent satellite data; the selection of past stages depend on data availability (Landsat TM, Landsat MSS, CORONA, any ancillary data). If available, multiple past stages will be analyzed in order to fully capture possible degradation trends (early 1970ies, 1990, 2000).

Finally the foregoing analytical steps allow for the derivation of a preliminary land degradation risk map:

- Elaboration of hazard classes based on the preceding degradation trend analysis and by integrating different factors for determination of land degradation risk classification using expert knowledge decision tree models.

## 4.2 Systematic Evaluation of open-source GIS software

A systematic evaluation of available open-source GIS software is necessary to identify the product best suited to the tasks foreseen in this project and best adopted to the specific conditions in Tajikistan. Among others, the discussed software packages ILWIS, QGIS and SAGA (see *Chapter 2.2.2*) will be evaluated regarding their power in executing exactly defined workflows. These workflows will focus on data capturing, data editing, raster based feature extraction and basic modelling tasks. For further details see *Chapter 3.4*.

## 4.3 Awareness creation and training workshop

A first one-day awareness creation workshop for decision-makers followed by a two-day training workshop will be held in November 2007 in Tajikistan (see also *Chapter 3.6*).

**Proposed dates:** Monday 26th November to Friday 30th November 2007.

**Duration:** 3 days

**Location:** Venue in Dushanbe still has to be defined. Possible locations would include the SSRI or the Tojikkoinot.

**Training staff:** GIS specialist from CDE (Switzerland) in close collaboration with local counterpart.

**Participants:** Decision-makers and GIS staff from the CAWMP, its Facilitating Organisations and from government institutions, already working with geospatial tools. For a preliminary list of potential participants see *Chapter 3.6.2*.

**Thematic focus:** Use of geospatial tools for land degradation assessment and natural resources management.

**Content:**

1) Launch of the land degradation database
2) Demonstration of open-source geospatial tool
3) Presentation of Pamir Web-GIS
4) Discussion of a Tajikistan-based Web-GIS application and identification of Web-GIS host institution
5) Identification of the current and planned GIS workflows of participating institutions and possible GIS software solutions

## 4.4 Final report

The final report is due at the end of December 2007.

**Proposed list of contents:**

1. Results from the systematic evaluation of open-source GIS software
2. Contents of GIS database
3. Historic land degradation trends analysis in the four watersheds (Zerafshan, Surkhob, Vanj and Toirsu)
4. Experiences from awareness creation and training workshop
5. Concept for web-based GIS application hosted in Tajikistan

## 4.5 Updated detailed schedule and plan for all outstanding activities

Activities so far accomplished include preparatory work, inception mission, mission's evaluation and completion of inception report. A detailed schedule of further project activities can be found in *Table 6*. Major next steps comprise:

1) Systematic evaluation of open-source GIS software (September 2007),
2) Compilation of GIS database for the four watersheds (October/November 2007),
3) Conducting awareness creation and training workshop in Dushanbe (November 2007),
4) Compilation and translation of GIS training materials and reference documents into Tajik and Russian (December 2007/January 2008)
5) Final report of land degradation trends in the four watersheds (December 2007).

*Table 6: Detailed schedule of activities*

| Month | Week | Activities in Tajikistan | Activities at the CDE | BNWPP |
|---|---|---|---|---|
| July | | | Preparatory work | |
| August | 32 | Inception Mission | | |
| | 33 | Inception Mission | | |
| | 34 | | Evaluation of inception mission | |
| | 35 | | Inception report | |
| September | 36 | Workshop 8 September | Inception Report | |
| | 37 | | Inception Report | |
| | 38 | | Evaluation of open source software | |
| | 39 | | Evaluation of open source software | |
| October | 40 | | Data acquisition | |
| | 41 | | Data acquisition | |
| | 42 | | GIS Database development | |
| | 43 | Vectorisation of data | GIS Database development | |
| | 44 | Data collection / preparation | GIS Database development | Inception report |
| November | 45 | Preparation of training workshop | GIS Database development | |
| | 46 | Preparation of training workshop | Preparation of training workshop | |
| | 47 | Data collection (tabular data) | Preparation of training workshop | |
| | 48 | Training workshop | | |
| December | 49 | Translation of training materials | Final report | - Materials for field work<br>- Concept for refined LD-assessment |
| | 50 | Translation of training materials | Final report | |
| | 51 | Translation of training materials | Final report | |
| | 52 | | | |

# 5 References & further reading

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GUNTLI, D. 2006. *Classification of Landcover and Landuse: An Object Oriented Approach in Western Tajikistan.* Master's Thesis. University of Zurich, Switzerland.

HERGARTEN, CH. 2004. *Investigations on Land Cover and Land Use of Gorno Badakhshan (GBAO) by Means of Land Cover Classifications Derived from LANDSAT 7 Data Making Use of Remote Sensing and GIS Techniques.* Master's Thesis. University of Bern, Switzerland.

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WOLFGRAMM, B. 2007. *Land Use, Soil Degradation and Soil Conservation in the Loess Hills of Central Tajikistan.* PhD Thesis. University of Bern, Switzerland.

# Annex

# List of government institutions and international organisations visited during inception mission in August 2007

| Date | Institution | Person |
|---|---|---|
| 06.08.2007 | Republican center for the farm privatization support under the Government of Tajikistan (PMU of CAWMP), Dushanbe | Tohir Ostonaev (Director)<br>Rustam Rakhimov (Land Management Specialist at the PMU)<br>Nigora Safarova (World Bank Dushanbe) |
| 06.08.2007 | Central Asian Mountain Partnership (CAMP) Kuhiston, Dushanbe | Murod Ergashev (Team Leader) |
| 07.08.2007 | Soil Science Research Institute (SSRI), Tajik Academy of Agricultural Sciences (TAAS), Dushanbe | Sanginboy Rajabovich Sanginov (Director)<br>Petr Sosim, Gulniso Nekushoeva<br>Murod Ergashev (Team Leader CAMP) |
| 07.08.2007 | State Committee of Statistics Republic of Tajikistan (GOSKOMSTAT), Dushanbe | Statistical book store |
| 07.08.2007 | Republican center for the farm privatization support under the Government of Tajikistan (PMU of CAWMP), Dushanbe | Rustam Rakhimov (Land Management Specialist) |
| 08.08.2007 | Agency for Land Management, Geodesy and Cartography under the Government of the Republic of Tajikistan, Dushanbe | Davlatsho K. Gulmahmadov (Director) |
| 08.08.2007 | The State Project Institute for Land Management ''Tojikzaminsoz'' (formerly known as GIPROZEM), Dushanbe | Khokimov Adukarim (Director) |
| 08.08.2007 | State Committee of Statistics (SCS) Republic of Tajikistan (GOSKOMSTAT), Dushanbe | Mukhammadieva Bakhtiya Ziyodulloevna (First deputy of the Chairman of the SCS of Tajikistan)<br>Abdulloev Abduumutalib (Head of Agriculture Statistics Department)<br>Olga Pulatova Mikhaelovna (Chief accountant of the transport statistics department)<br>Haitov Sultanboy Aslibekovich (Head of census department) |
| 08.08.2007 | Welt Hunger Hilfe (German Agro-Action) | Sadriddin Juraev (Project Assistant in Pendjikent) |
| 08.08.2007 | Agency for Technical Cooperation and Development (ACTED), Dushanbe | Muslim Bandishoev (GIS specialist) |
| 09.08.2007 | UN Coordination Unit in Tajikistan, Dushanbe | Farroukh Nazarmavloev (Monitoring and Evaluation Coordinator) |
| 09.08.2007 | Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) / Deutscher Entwicklungsdienst (ded) | André Fabian (Technical Advisor) |
| 09.08.2007 | Strategic Research Center under the President of the Republic of Tajikistan, Dushanbe | Yussuff R. Yusufbekov (Project Coordinator)<br>Shahob M. Rahimov (GIS specialist)<br>Gunay Jalilova (Project Assistant) |
| 10.08.2007 | Project Research Institute FAZO, Dushanbe | Shahbozov Shahboz Amzapievich (Main Engineer) |
| 10.08.2007 | Tajik Research Institute of hydraulic engineering and land reclamation (TajikNIIGiM), Dushanbe | Pulatov Yarash Ergashevich (Professor) |
| 10.08.2007 | Central Asian Mountain Partnership (CAMP) Kuhiston, Dushanbe | Murod Ergashev (Team Leader) |
| 10.08.2007 | United Nations Development Programme (UNDP), Dushanbe | Mubin Rustamov (Senior Economic Adviser Communities Programme) |

| Date | Institution | Person |
|---|---|---|
| 11.08.2007 | Welt Hunger Hilfe (German Agro-Action), Pendjikent | Simon Greuter (Head of Project) |
| 12.08.2007 | Welt Hunger Hilfe (German Agro-Action), Pendjikent<br>Field visit to Artuch, Panchrut, Tagobi Khal and Iskodar village | Furkat Burhonov (WHH)<br>Rustam Rahimov (PMU of CAWMP)<br>Saidjon Shodiev (director of PCU in Ayni) |
| 12.08.2007 | PCU of the CAWMP for Zerafshan watershed, Ayni | Shoradjabov Azim (Community development specialist)<br>Saodatullo Davronov (Finance, monitoring and evaluatin specialist) |
| 15.08.2007 | The State Project Institute for Land Management ''Tojikzaminsoz'' (formerly GIPROZEM), Dushanbe | Karimov Azizmahmad (deputy director)<br>Saldkovaya Tamara (Leader of the Laboratory for Soil Quality Analysis)<br>Elena Lavrenko (Leader of the Technical Archive) |
| 15.08.2007 | Swiss Agency for Development and Cooperation (SDC), Dushanbe | Matthias Anderegg (Disaster Reduction Programme) |
| 15.08.2007 | United Nations Development Programme / UN Disaster Risk Management Project (UNDRMP), Dushanbe | Nodira Karizoda (Information Management Specialist)<br>Khusrav Sharifov ( Project Manager) |
| 16.08.2007 | Food and Agriculture Organization (FAO) of the United Nations, Dushanbe | Bernhard Schelhas (Coordinator for Tajikistan)<br>Sanginboy Rajabovich Sanginov (Director of the SSRI) |
| 16.08.2007 | World Bank Office, Dushanbe | Nadita Jain (World Bank Consultant) |
| 17.08.2007 | Agency on Hydrometeorology, Republic of Tajikistan, Dushanbe | Mahmadaliev Begmurod Ubaidovich (Director)<br>Mahmad Safarov (First deputy) |
| 17.08.2007 | World Bank Office, Dushanbe | Bobojon Yatimov (Rural Community Development Specialist) |
| 17.08.2007 | Ministry of Emergency Situations and Civil Defense of Tajikistan, Information Management and Analytical Center (IMAC), Dushanbe | Aliso Shomahmadov (Head of IMACr)<br>Alexander Kashilov (Chief of ECO-GIS public Foundation Kyrgyzstan)<br>Nodira Karizoda (Information Management Specialist, UNRDMP) |
| 18.08.2007 | PCU of the CAWMP for Toirsu watershed, Dangara<br>Visit to Jamoat support center in Lolazur | Alimurod Tagoev (Rural Engineer)<br>Abdujabor Khakimov (Agriculture Specialist; FAO) |

# GIS fact sheets of visited institutions

| 1. General Information, 06.08.2007 | |
|---|---|
| Institution | Republican center for the farm privatization support under the Government of Tajikistan |
| Address | 44 Rudaki street, 734025 Dushanbe, Tajikistan |
| Contact person | Tohir Ostonaev (director)<br>Rustam Rahimov (land management specialist) |
| Phone & Fax | Tohir Ostonaev: 8 (992 37) 221 85 66, 221 00 21,<br>Rustam Rahimov: Mobile: 918747808, Work: 2212789<br>Fax: 8 (992 37) 251 01 17 |
| e-mail | Center_c@tojikiston.com<br>R_rustam@mail.ru |
| Homepage | - |
| Field of competence | Agriculture development |
| Background | Government Institution |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | - 1998 - 2005: Agriculture Privatization Project in Kathlon Oblast<br>- 2004: in cooperation with Lahmeyer International Consulting Germany, GIS training for the State Land Committee |
| Current projects | - Community Agriculture and Watershed Management Project (CAWMP)<br>- Agricultural Infrastructure West Tajikistan (ends 31.08.2007) |
| Planned projects | Bird Flue Project Tajikistan |
| GIS workflows carried out (digitizing, mapping, modelling) | - Digitalization (scanning), edit in Photoshop, digital corrections in ArcView, map printing |
| RS workflows carried out (georeferencing, classifying, modelling) | - |
| **3. Personnel** | |
| Staff | 1 (Rustam Rahimov) |
| Background / education | Land management specialist (engineer) Tashkent University |
| Languages | Tajik, Russian, Uzbek, English |
| **4. Hardware (specify type)** | |
| Computer | Dell inspiron 6400 laptop, centrino duo processor |
| WebServer | - |
| Printer / Plotter | HP designJET 500 |
| Scanner | Vidar Truscan Titan |
| GPS equipment | - |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | Very difficult working with web-GIS, however loading and downloading possible |

| 5. Software (list all, specify type) | |
|---|---|
| Operating System(s) | Windows Professional |
| GIS software | ArcView 3.1 Russian version installed, ArcView 8 English version available, but not in use |
| RS software | - |
| GPS software | - |
| Database software | Excel, Access |
| License costs | ArcView 8: 8.000 US$ |
| Language: graphical user interface, training manuals | Russian (rarely working with English version)<br>Training manual in Russian from Lahmeyer International Consulting Germany, Bad Vibel |
| **6. Data** | |
| Data processed | Paper maps |
| Access to data (government,…) | Tojikzaminsoz (Large map archive) |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | |
| On-the-job training topics | General practical training requested |
| Preferred training software (open-source software?) | ArcView 3.1 Russian version |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | TOJIKZAMINSOZ, FAZO<br>And Facilitating Organization for the CAWMP: UNDP, AKF, FAO, WHH |
| **9. General Comments** | |
| Downloaded data from the Pamir WebGIS for the CAWMP (Vanj)<br>Use GoogleEarth<br>Very interested in GIS | |

| 1. General Information 07.082007 | |
|---|---|
| Institution | Tajik Academy of Agricultural Sciences - Soil Science Research Institute |
| Address | Rudaki 21a, 734025 Dushanbe |
| Contact person | Sanginboy Rajabovich Sanginov (director)<br>Piotr M. Sosin |
| Phone & Fax | (992 372) 27 19 79, 27 65 44<br>Fax: (992 372) 21 32 79<br>P. M. Sosin: 919 00 17 25 |
| e-mail | sanginov@yahoo.com, soil2004@mail.ru |
| Homepage | |
| Field of competence | Soil sciences, soil surveys, erosion maps, vegetation maps |
| Background | Tajik Academy of Agricultural Sciences (TAAS) |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | - |
| Current projects | Soil mapping, CACILM (Central Asian Country Initiative for land management) from ICARDA, erosion modelling based on Cs-137 measurements (IAEA) |
| Planned projects | - |
| GIS workflows carried out (digitizing, mapping, modelling) | GIS workflows are just now being established suitable for the creation of a soil database, spatially explicit data representation and analysis: Georeferencing and vectorisation of existing soil maps and soil survey maps, attribution with historic soil property data. |
| RS workflows carried out (georeferencing, classifying, modelling) | Planning of future soil surveys based on old soil data in comparison with recent satellite imagery: Georeferencing, unsupervised classification, application of indexes such as NDVI. |
| **3. Personnel** | |
| Staff | Gulniso Nekushoeva (NCCR North-South PhD student) |
| Background / education | Soil mapping |
| Languages | Russian, Tajik, English |
| **4. Hardware (specify type)** | |
| Computer | HP Compaq |
| WebServer | - |
| Printer / Plotter | HP designJet 500 Plus |
| Scanner | EPSON A3 GT-15000 |
| GPS equipment | 4 GPSmap 60 Garmin |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | One fast connection, one very slow connection |
| **5. Software (list all, specify type)** | |

| | |
|---|---|
| Operating System(s) | windows |
| GIS software | MapInfo Professional; ArcView 3.2 and ArcGIS 9.2 |
| RS software | - |
| GPS software | DNR Garmin |
| Database software | - |
| License costs | MapInfo: 3000 US$ |
| Language: graphical user interface, training manuals | English |
| **6. Data** | |
| Data processed | Thematic soil atlas |
| Access to data (government,...) | Own sources, GOSKOMSTAT, GOSKOMZEM, NCCR North-South |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | Basic including GPS handling |
| On-the-job training topics | Basic including GPS handling |
| Preferred training software (open-source software?) | Best with ArcGIS 9 |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | NCCR North-South, FAO, ICARDA, IAEA |
| **9. General Comments** | |
| They have just started with GIS work<br>Offer to perform training courses at the SSRI: could provide 4 computers, beamer, fast internet connection, scanner, plotter and Mapinfo software.<br>Have the Tajik Thematic Atlas (two volumes)<br>Received GIS training through the International Atomic Energy Agency (IAEA) in August/September 2007 | |

| 1. General Information 08.08.2007 | |
|---|---|
| Institution | The State Project Institute for Land Management ''Tojikzaminsoz'' (formerly known as GIPROZEM) |
| Address | GIPROZEM Gorodok 15, Dushanbe |
| Contact person | Abdukarim Hakimov (director)<br>Azizmahmad Karimov (deputy director) |
| Phone & Fax | Hakimov 992-372 310517; 311983<br>Karimov: 907 77 33 99 (mobile) |
| e-mail | |
| Homepage | |
| Field of competence | Tasks: land user registration, agricultural land cadastre, land use certificates, soil monitoring, economic land assessment, issue of soil "passports", geo-botanical survey on pastures |
| Background | Are now under the Agency for Land Management, Geodesy and Cartography under the Government of the Republic of Tajikistan |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | - |
| Current projects | Permanent renewal of paper maps through field surveys, renew maps every 5-10 years |
| Planned projects | - |
| GIS workflows carried out (digitizing, mapping, modelling) | Digitalization, create vector data, mapping with GPS, integration of GPS points into GIS<br>Scan paper maps and perform editing/correction/updates in GIS according to field surveys they conducted |
| RS workflows carried out (georeferencing, classifying, modelling) | - |
| **3. Personnel** | |
| Staff | 9 |
| Background / education | |
| Languages | Russian, Tajik |
| **4. Hardware (specify type)** | |
| Computer | 2 |
| WebServer | - |
| Printer / Plotter | HP designJet 500, 450 C |
| Scanner | Vidar Truscan titan, FSS 4300 DSP full scale scanner CONTEX |
| GPS equipment | 5 |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | none |
| **5. Software (list all, specify type)** | |
| Operating System(s) | Windows Professional |

| | |
|---|---|
| GIS software | ArcGIS 8, ArcView 3.2 |
| RS software | |
| GPS software | SKI-Pro (Leica), AutoCAD, AutoDesk |
| Database software | SKI-Pro |
| License costs | Received it from CAWMP |
| Language: graphical user interface, training manuals | English |
| **6. Data** | |
| Data processed | Paper maps, GPS points, mostly paper data that is digitized and edited |
| Access to data (government,…) | Own Archive: national archive |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | Very basic |
| On-the-job training topics | Very basic |
| Preferred training software (open-source software?) | |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | |
| **9. General Comments** | |
| Just started with GIS, in general all hand work (with ink on special paper for archive)<br>Question for Training: how to create topographic maps with GIS?<br>They were very interested in the PamirWebGIS, but cannot download the data, because no internet access. | |

| 1. General Information 08.08.2007 | |
|---|---|
| Institution | Agency for Technical Cooperation and Development (ACTED) |
| Address | Rajabov str. 15, Dushanbe |
| Contact person | Muslim Bandishoev (GIS specialist) |
| Phone & Fax | 919010548 (Mobile) |
| e-mail | Muslim.bandishoev@acted.org |
| Homepage | www.acted.org |
| Field of competence | Emergency Relief, Food Security, Health Promotion Network, Economic Development, Education and Training, Micro finance, Advocacy - Institutional Support and Regional Dialogue, and Cultural promotion |
| Background | International relief agency with headquarters in Paris, France. |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | - 2004: DIPECHO (Disaster Preparedness ECHO); received GIS equipment for this project and handed it over to the Centre of Competence for Disaster Reduction (CCDR; established by Swiss Agency for Development and Cooperation) at the end of project phase<br>- digitized Dushanbe area on the basis of satellite image and collected information themselves to add as attributes |
| Current projects | none |
| Planned projects | |
| GIS workflows carried out (digitizing, mapping, modelling) | Digitizing, create vector data, mapping |
| RS workflows carried out (georeferencing, classifying, modelling) | - |
| **3. Personnel** | |
| Staff | 1 |
| Background / education | Mathematic specialist |
| Languages | Tajik, Russian, English |
| **4. Hardware (specify type): ACTED has NO equipment at the moment. Handed it over to CCDR!** | |
| Computer | 1 |
| WebServer | - |
| Printer / Plotter | HP desgnJetPS500 |
| Scanner | - |
| GPS equipment | 1, Garmin GPSmap 76 |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | Good internet connection |
| **5. Software (list all, specify type)** | |
| Operating System(s) | Windows Professional |

| | |
|---|---|
| GIS software | ArcView 8.3 / ArcPress 8.3 |
| RS software | - |
| GPS software | OziExplorer |
| Database software | Access, Visual FoxPro |
| License costs | 3900.- Euros |
| Language: graphical user interface, training manuals | English<br>GIS manual for ArcView 8.3 available |
| **6. Data** | |
| Data processed | Bought satellite images (with SDC funds) of Dushanbe (QuickBird) |
| Access to data (government,...) | Collected data through field surveys |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | - |
| On-the-job training topics | - |
| Preferred training software (open-source software?) | - |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | CDE, CCDR, SDC |
| **9. General Comments** | |
| Have no GIS equipment at the moment, handed it over to the CCDR after project completion<br>Have 1 well skilled staff (attended GIS courses in Moscow), who already conducted GIS training courses<br>He would be very interested in working again with GIS or conducting further trainings | |

| 1. General Information 09.08.2007 | |
|---|---|
| Institution | Strategic Research Center under the President of the Republic of Tajikistan: Project "Building Information Capacity for Local Governance" |
| Address | Rudaki str. 40, office 610, Dushanbe |
| Contact person | Yusuff R. Yusufbekov (Project Coordinator)<br>Shahob M. Rahimov (GIS Specialist)<br>Gunay Jalilova (Project Assistant) |
| Phone & Fax | Yusuff R. Yusufbekov: (+992 37) 227 2230, 227 2374, Mobile: (+992) 93 5089087<br>Shahob M. Rahimov: Mobile: (+992) 907760690<br>Gunay Jalilova: Mobile: (+992) 917 820736 |
| e-mail | Yusuff R. Yusufbekov: src_project@bk.ru<br>Shahob M. Rahimov: shahob_rahimov@hotmail.com<br>Gunay Jalilova: gunay_d@yahoo.com |
| Homepage | www.src.gov.tj |
| Field of competence | Building Information Capacity for Local Governance<br>Create maps of national statistical data -> visualization of statistical data |
| Background | Directly under the President of Tajikistan |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | |
| Current projects | Building Information Capacity for Local Governance<br>Poverty Assessment (UNDP) |
| Planned projects | To use also GPS for field surveys and verification |
| GIS workflows carried out (digitizing, mapping, modelling) | visualization of socio-economic statistical data at jamoat, district and oblast levels |
| RS workflows carried out (georeferencing, classifying, modelling) | |
| **3. Personnel** | |
| Staff | 1 (Shahob M. Rahimov) |
| Background / education | Computer specialist (has already 1.5 years of experiences with GIS) |
| Languages | Tajik, Russian, English |
| **4. Hardware (specify type)** | |
| Computer | 1 used for GIS work: Dual core processor 3.0 GHZ, 2 GB RAM, 160 GB hard disk |
| WebServer | - |
| Printer / Plotter | Common office printer |
| Scanner | A4 |
| GPS equipment | - |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | Relatively fast internet connection<br>Pamir WebGIS is working, however slowly |

| 5. Software (list all, specify type) | |
|---|---|
| Operating System(s) | Windows Professional |
| GIS software | ArcMap 9.1 (received from UNDP) |
| RS software | - |
| GPS software | - |
| Database software | Excel, SPSS 12 |
| License costs | - |
| Language: graphical user interface, training manuals | English |
| **6. Data** | |
| Data processed | Socio-economic statistics |
| Access to data (government,...) | UNDP provided GIS data<br>Statistics from the State Committee of Statistics or directly from its branches in the oblast, district and jamoat centres. |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | What are the possibilities to work with GIS? |
| On-the-job training topics | General practical training |
| Preferred training software (open-source software?) | ArcGIS 9.2 (or any other new GIS software) |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | UNDP, GOSKOMSTAT |
| **9. General Comments** | |
| Worked with the free software DevInfo 5 (www.devinfo.org) and participated in training course conducted by UNDP (trainers: Farroukh Nazarmavloev, Farhod Khamidov, and Muslim Bandishoev) | |

| 1. General Information 10.08.2007 | |
|---|---|
| Institution | Scientific project institute FAZO |
| Address | Shamsi str. 5, Dushanbe |
| Contact person | Shahbozov Shahboz Amzapievich |
| Phone & Fax | 2-36-48-13, Mobile: 93-504-69-98 |
| e-mail | - |
| Homepage | - |
| Field of competence | Create land cadastre maps |
| Background | Under the Agency for Land Management, Geodesy and Cartography under the government of Tajikistan |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | |
| Current projects | EU TACIS, Finnmap Nov. 2006 to Nov. 2008: training in Photogrammetry and Geodesy |
| Planned projects | |
| GIS workflows carried out (digitizing, mapping, modelling) | Digitize and update paper maps with ArcView 3.2 (covering 25 Rayons)<br>Create settlement maps (cadastre maps) for taxing purposes |
| RS workflows carried out (georeferencing, classifying, modelling) | It is planned to work with satellite pictures, too |
| **3. Personnel** | |
| Staff | 20 |
| Background / education | Different specialists |
| Languages | Tajik, Russian, a few have English language skills |
| **4. Hardware (specify type)** | |
| Computer | 20 |
| WebServer | - |
| Printer / Plotter | 1, HP designJet 500 |
| Scanner | 1, Vidar TruScan Titan, 1 plain scanner |
| GPS equipment | 2 Leica GPS systems 500 |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | none |
| **5. Software (list all, specify type)** | |
| Operating System(s) | Windows |
| GIS software | ArcView 3.2 (from the CAWMP), AutoCAD, ArcView 8 (from the Swedesurvey project) |
| RS software | - |
| GPS software | SKI-Pro (Leica) |

| | |
|---|---|
| Database software | Excel |
| License costs | - |
| Language: graphical user interface, training manuals | Russian, English |
| **6. Data** | |
| Data processed | Paper maps from their archive |
| Access to data (government,...) | Own archive |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | They still have information separated from map (write a number in ArcView that refers to an entry in a excel sheet.<br>Need training on how the get their data sheet connected to the map in ArcView |
| On-the-job training topics | With newer software |
| Preferred training software (open-source software?) | Russian language, best with ArcView 9 or with other new software |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | EU TACIS project with Finnmap (Kotzev and Kaczinsky):<br>Kotzev: GPS and Satellite images<br>Kaczinsky: digital Photogrammetrie |
| **9. General Comments** | |
| Ake Olson worked with the Agency for Land Management, Geodesy and Cartography and performed GIS training (ArcView 8)<br>Received Plotter and Scanner from the CAWMP<br>They bought themselves Computer equipment<br>Also had training from Lahmeyer Consultants (within the CAWMP)<br>They have 2 theodolites: Leica TCR 303 from EU TACIS project | |

| 1. General Information 10.08.2007 | |
|---|---|
| Institution | Tajik research Institute of hydraulic engineering and land reclamation (NPO TajikNIIGiM) |
| Address | Shamsi street 5/1, Dushanbe |
| Contact person | General director: Pulatov Yarash Ergashevich<br>Responsible for GIS: Daler Domullochomov |
| Phone & Fax | Director: (992 372) 35-35-23, 36-59-40, Mobile: (992 91) 902-14-11 |
| e-mail | Tj_water@mail.ru<br>Daler: dalerd@list.ru |
| Homepage | - |
| Field of competence | Dynamic of land use and hydrology |
| Background | A research unit of the Ministry of Hydraulics and Melioration |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | - |
| Current projects | - |
| Planned projects | - |
| GIS workflows carried out (digitizing, mapping, modelling) | - |
| RS workflows carried out (georeferencing, classifying, modelling) | - |
| **3. Personnel** | |
| Staff | 1 (Daler Domullochomov) |
| Background / education | Master from Agrarian University (Meloriation and Evironmental Issues) |
| Languages | Tajik, Russian, English (is able to work with English user interface) |
| **4. Hardware (specify type)** | |
| Computer | HP, Intel penitum 4, 128 RAM, 1.7 GHz, 120 GB harddisk |
| WebServer | - |
| Printer / Plotter | HP designJet 500 and HP designJet 750C |
| Scanner | Vidar TruScan Select |
| GPS equipment | - |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | - |
| **5. Software (list all, specify type)** | |
| Operating System(s) | Windows 2000 Professional |
| GIS software | GIS software was uninstalled, had ArcView 3.2 |
| RS software | - |

| | |
|---|---|
| GPS software | - |
| Database software | - |
| License costs | - |
| Language: graphical user interface, training manuals | Russian and English |
| **6. Data** | |
| Data processed | - |
| Access to data (government,...) | - |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | |
| On-the-job training topics | General practical training |
| Preferred training software (open-source software?) | |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | TACIS, EU Commission |
| **9. General Comments** | |
| Person who was in charge of GIS died. They just recently dug out their GIS equipment and want to work with it again.<br>Daler Domullochomov has some experiences with ArcView 3.2, AutoCAD, Coreldraw. He attended no GIS training but has been instructed by the previous GIS worker at the institute. | |

| 1. General Information 17.08.2007 | |
|---|---|
| Institution | Ministry of Emergency Situations and Civil Defense of Tajikistan<br>Information Management and Analytical Center (IMAC) |
| Address | 26 Lohuti str., 734025 Dushanbe, Tajikistan |
| Contact person | Alisho Shomahmadov (Head) |
| Phone & Fax | (+992) 372 215650<br>Mobile: (+992) 917 747394 |
| e-mail | Alisho.Shomahmadov@mchs.tj |
| Homepage | www.mchs.tj |
| Field of competence | Emergency Preparedness and Disaster Risk Management |
| Background | IMAC was established with the support of the SDC (all equipment was provided) |
| **2. Activities (implementing GIS)** | |
| Projects accomplished | |
| Current projects | Digitize risk maps 1:500'000 (already 8 maps completed) |
| Planned projects | It is planned to work also with satellite images in the future |
| GIS workflows carried out (digitizing, mapping, modelling) | Digitize paper maps from 1984, create vector and polygon layers |
| RS workflows carried out (georeferencing, classifying, modelling) | - |
| **3. Personnel** | |
| Staff | 4 |
| Background / education | IT-specialists |
| Languages | Tajik, Russian, English |
| **4. Hardware (specify type)** | |
| Computer | 4 computers, 2.2 GHz processor |
| WebServer | Dell PowerEdge 800 IntelXeon (extern)<br>see: http://www.dell.com/content/products/productdetails.aspx/pedge_800<br>They also have a intranet server |
| Printer / Plotter | HP designJet 800PS |
| Scanner | A3 EPSON GT 15000 |
| GPS equipment | - |
| Speed of internet access (PamirGIS-test)<br>http://www.pamir-gis.info | |
| **5. Software (list all, specify type)** | |
| Operating System(s) | Windows |
| GIS software | ArcGIS 9.2 |

| | |
|---|---|
| RS software | ERDAS |
| GPS software | - |
| Database software | SQL Server 2005 |
| License costs | |
| Language: graphical user interface, training manuals | English |
| **6. Data** | |
| Data processed | Paper maps 1:500'000 from 1984 |
| Access to data (government,...) | Tojikoinot and other government institutions (have contracts with 12 government institutions) |
| **7. Training requirements (GIS and RS)** | |
| Preferred theoretical inputs | - |
| On-the-job training topics | - |
| Preferred training software (open-source software?) | - |
| **8. Collaboration with partner institutions** | |
| Name of collaborating institutions | SDC, UNDP, UNDRMP, ECO-GIS |
| **9. General Comments** | |
| ECO-GIS public foundation from Kyrgyzstan provides support to the IMAC as a consultant through the UNDRMP | |

# Budget of the Swiss CTF support

| Item | US$ |
|---|---|
| International specialists fees 70 days at $600 equivalent/day | 42,000 |
| Two trips to Tajikistan (travel, lodging and fees) | 12,000 |
| Data, software, and other materials | 9,000 |
| Translation, interpretation, logistics, and other local consultant support (fees and in country travel) | 9,000 |
| Dissemination expenses | 3,000 |
| Total | 75,000 |